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Utilization of the LADAS model within Emergency Response Systems in Korea

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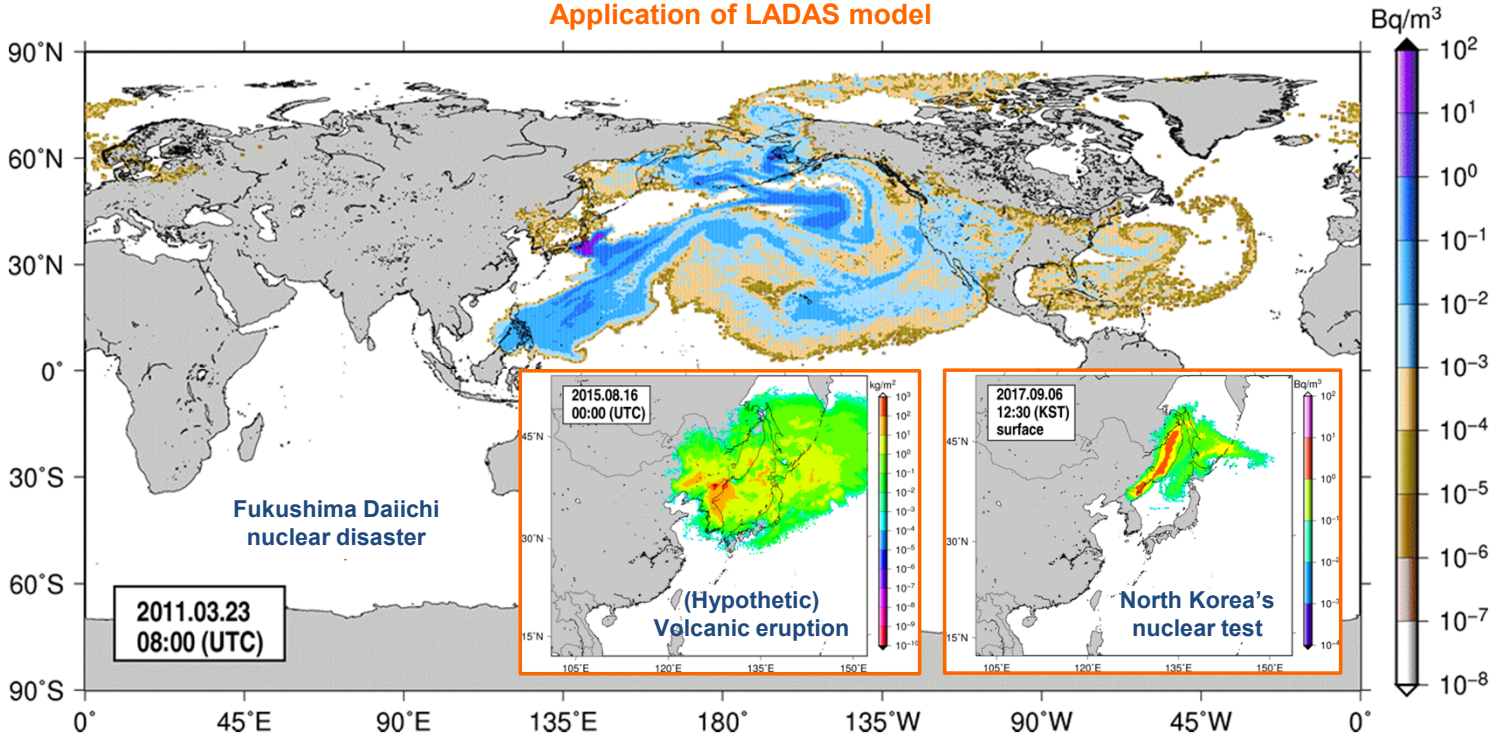
Lagrangian Atmospheric Dose Assessment System (LADAS) @ KAERI

Application of LADAS model



LADAS (2006)

- ✓ KAERI's own ATDM
- ✓ global / regional / (local) scale
- ✓ fast calculation (MPI)
- ✓ use KMA's NWP data
- ✓ ATDM in RAPS-K

LADAS-Volcanic Ash (2015)

- ✓ derivative of LADAS (VATDM)
- ✓ based on LADAS-regional
- ✓ fast calculation (simple physics)
- ✓ (default) VATDM in VDRS

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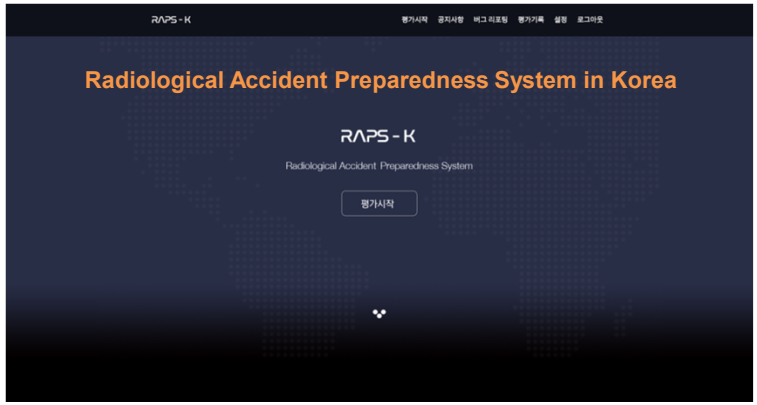
Introduction: Emergency Response Systems utilizing LADAS model



LADAS in RAPS-K

- ✓ Operation by KAERI (nuclear accident)
- ✓ Global / Regional (East Asia) / (Local)
- ✓ Related governmental agencies (User Group)
- ✓ LADAS → Dose calculation
- ✓ Employ HPC for fast calculation

LADAS-VA in VDRS

- ✓ Operation by MOIS (volcanic eruption)
- ✓ Regional (Far East Asia)
- ✓ Public officers in MOIS / local governments
- ✓ LADAS-VA → fallout ash / PM10 / airway
- ✓ Use virtual calculation server (docker image)

Common features

- ✓ Governmental Use Only (not opened to public)
- ✓ Web based GUI
- ✓ Real-time NWP data (KMA)
- ✓ Provide countermeasures
- ✓ Scenario development → Training program (feedback)
- ✓ Almost get ready for operation

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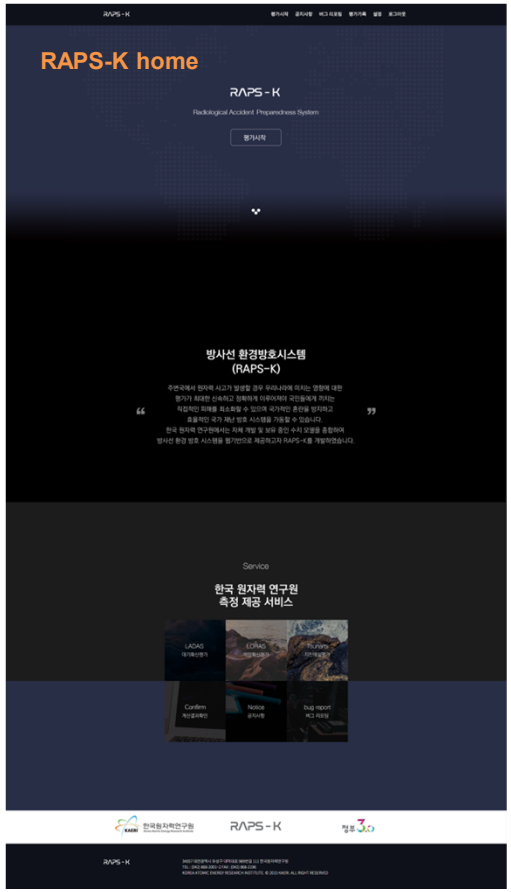

Radiological Accident Preparedness System in Korea (prototype)

RAPS-K 평가시작 공지사항 버그 리포팅 평가기록 설정 로그아웃

대기확산평가(LADAS) ✓ Atmospheric dispersion
해양확산평가(LORAS) ✓ Oceanic dispersion
선량평가 ✓ Dose calculation

Use HPC for fast calculation

RAPS-K

Radiological Accident Preparedness System

평가시작

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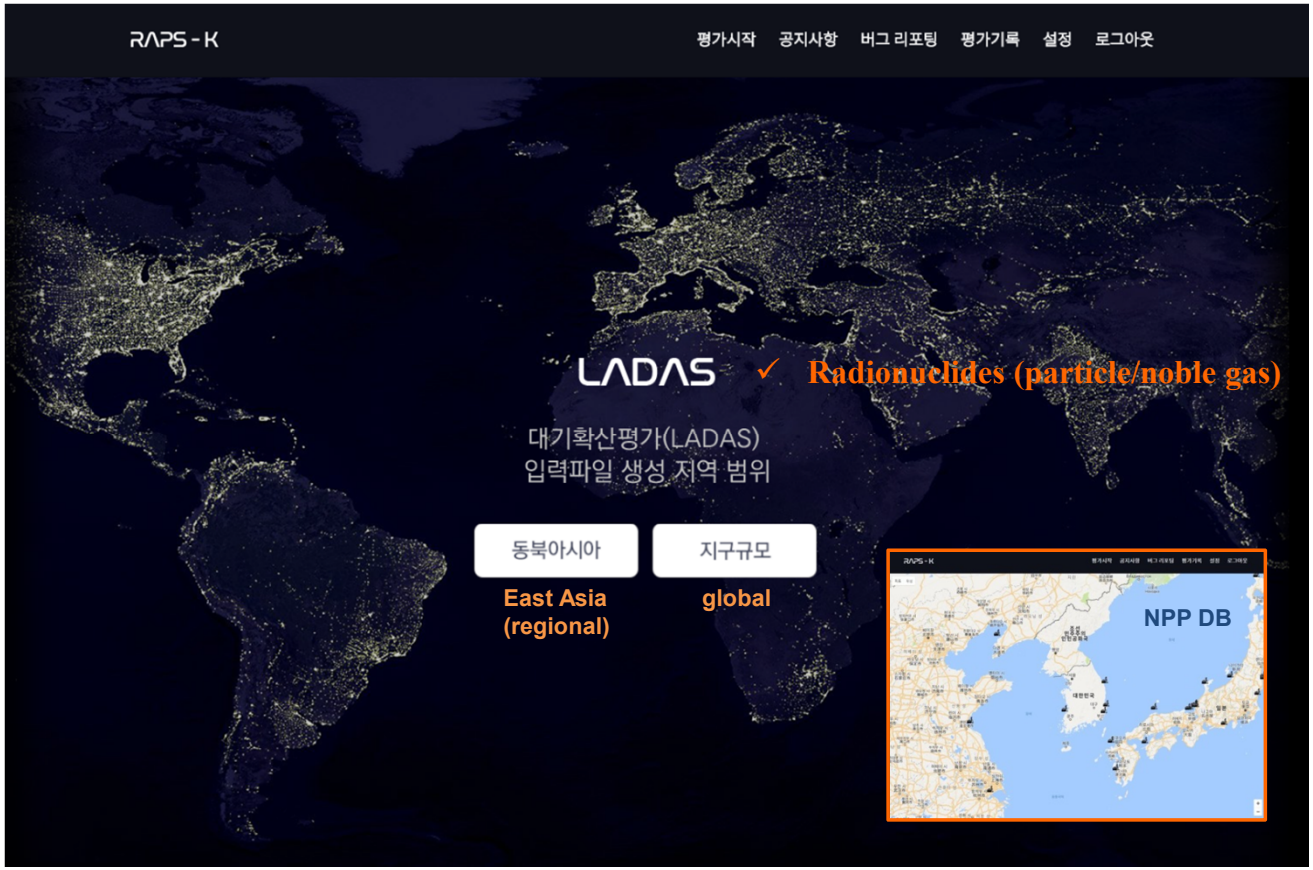

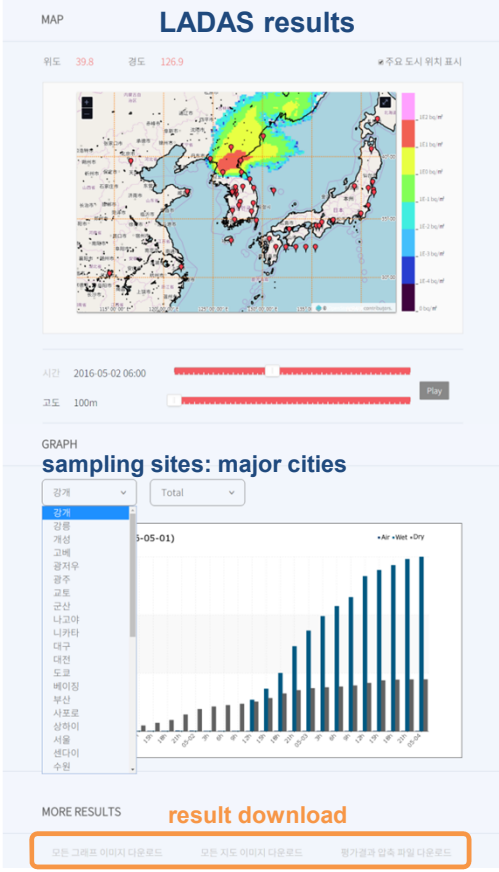

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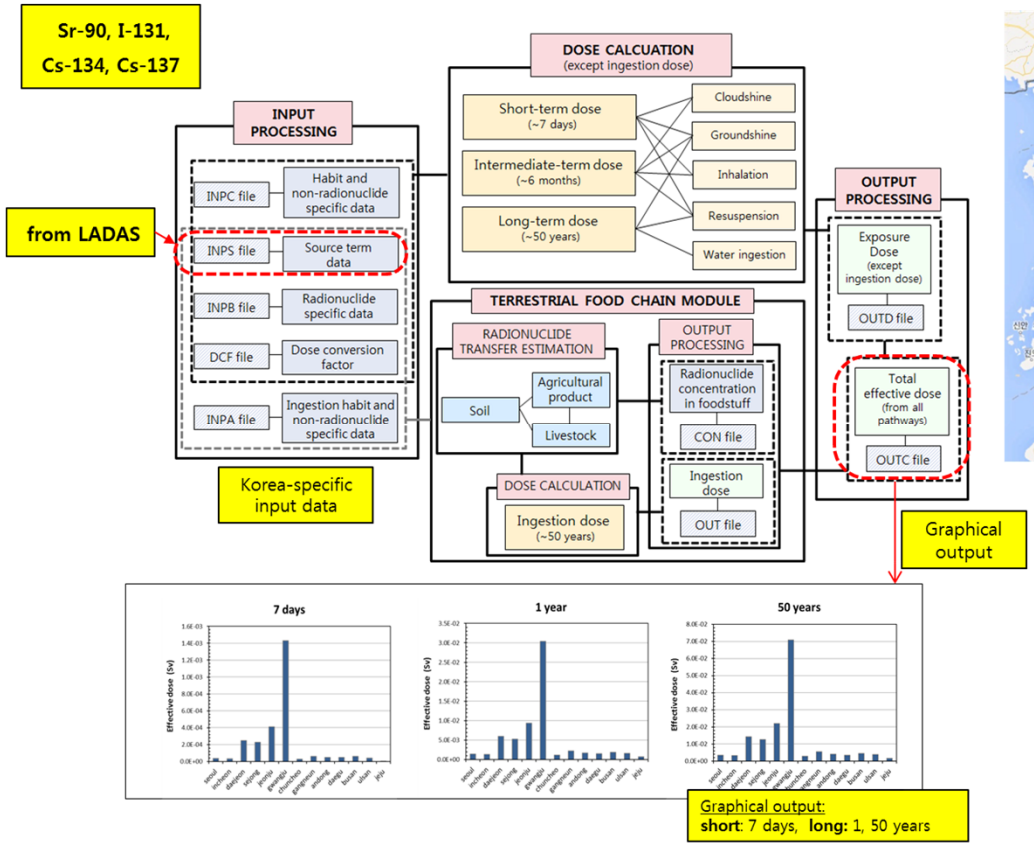
Dose calculation module



	City
1	Seoul
2	Incheon
3	Daejeon
4	Sejong
5	Jeonju
6	Gwangju
7	Chuncheon
8	Gangneung
9	Andong
10	Daegu
11	Busan
12	Ulsan
13	Jeju

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- ✓ Based on LADAS (atmospheric dispersion) results
- ✓ Use Korea-specific input parameters
- ✓ Food chain model (terrestrial/aquatic)

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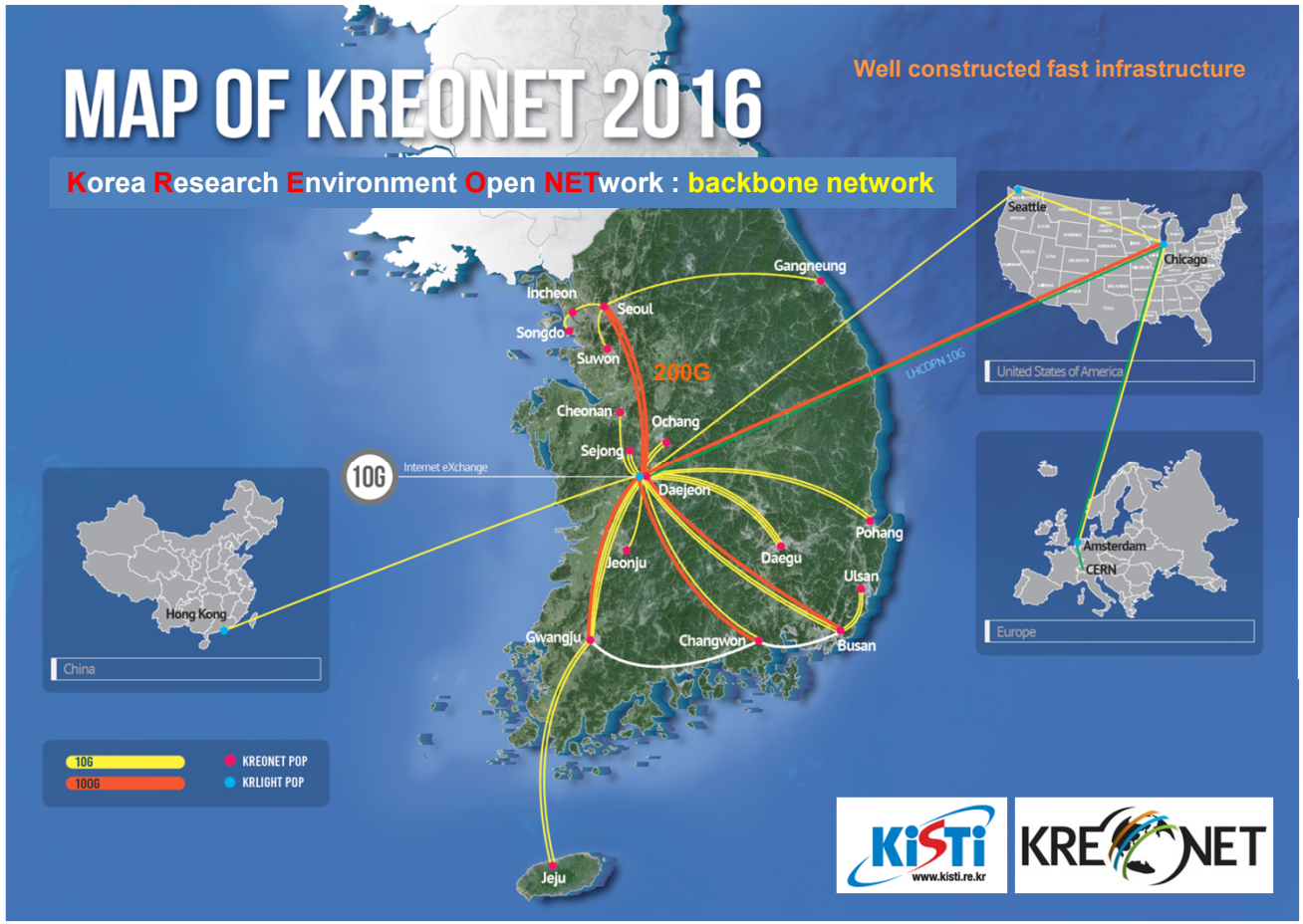

Real-time NWP data receiving via KREONET for RAPS-K operation

Korea Meteorological Administration → KiSTi www.kisti.re.kr → KAERI

Seoul	200G KREONET Seoul to Daejeon	Daejeon

- ✓ **KREONET backbone:** private/internal network with 1~100G (max 200G)
- ✓ **KISTI to KAERI:** 1G private/exclusive use

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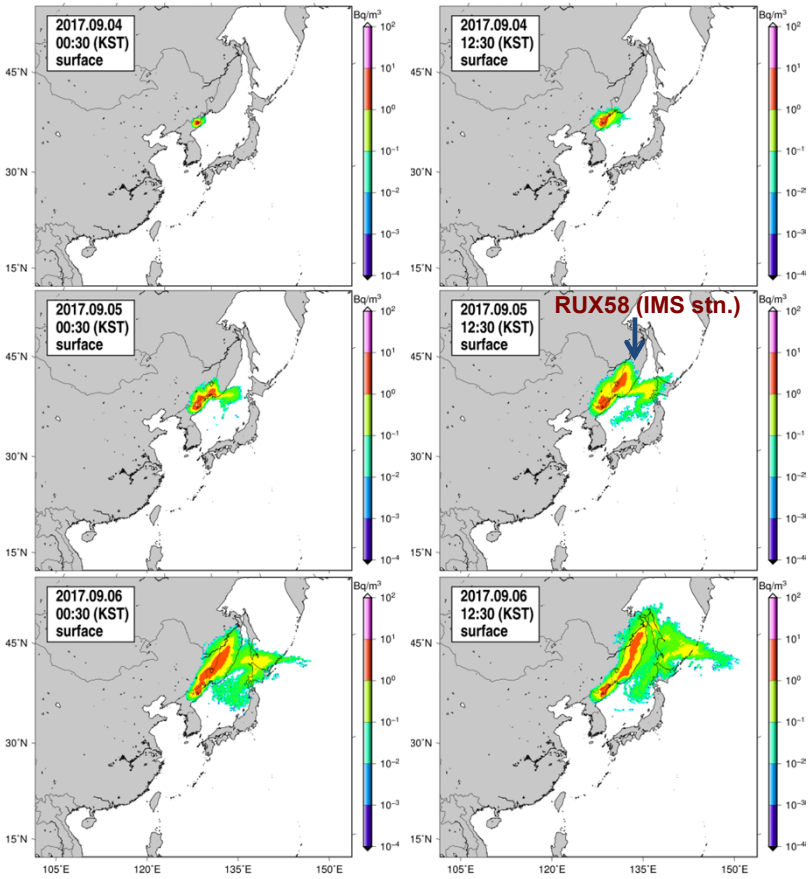


North Korea's 6th nuclear test

time & location (KMA)

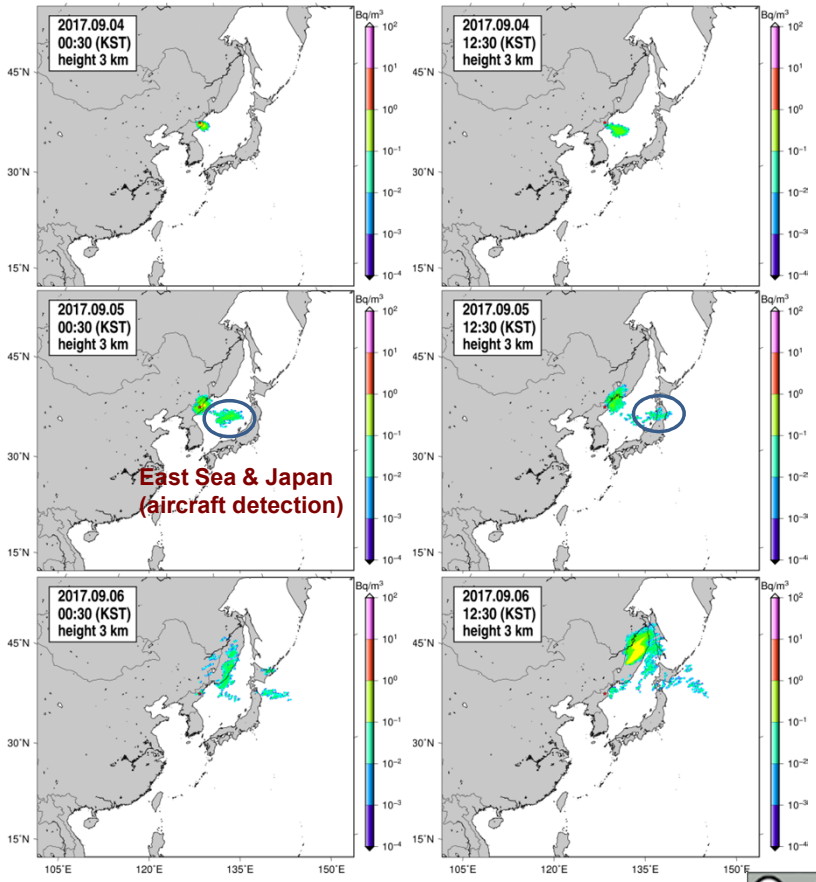
- 2017-09-03 12:29 KST
- near Punggye-ri NTS (41.302°N, 129.080°E)

Xe-133 emission scenario

- immediate emission
- 72h continuous release

possible detection site

- RUX58 station (surface)
- middle of East Sea & Akita in Japan (aircraft)
- undetectable in Korea (not detected)



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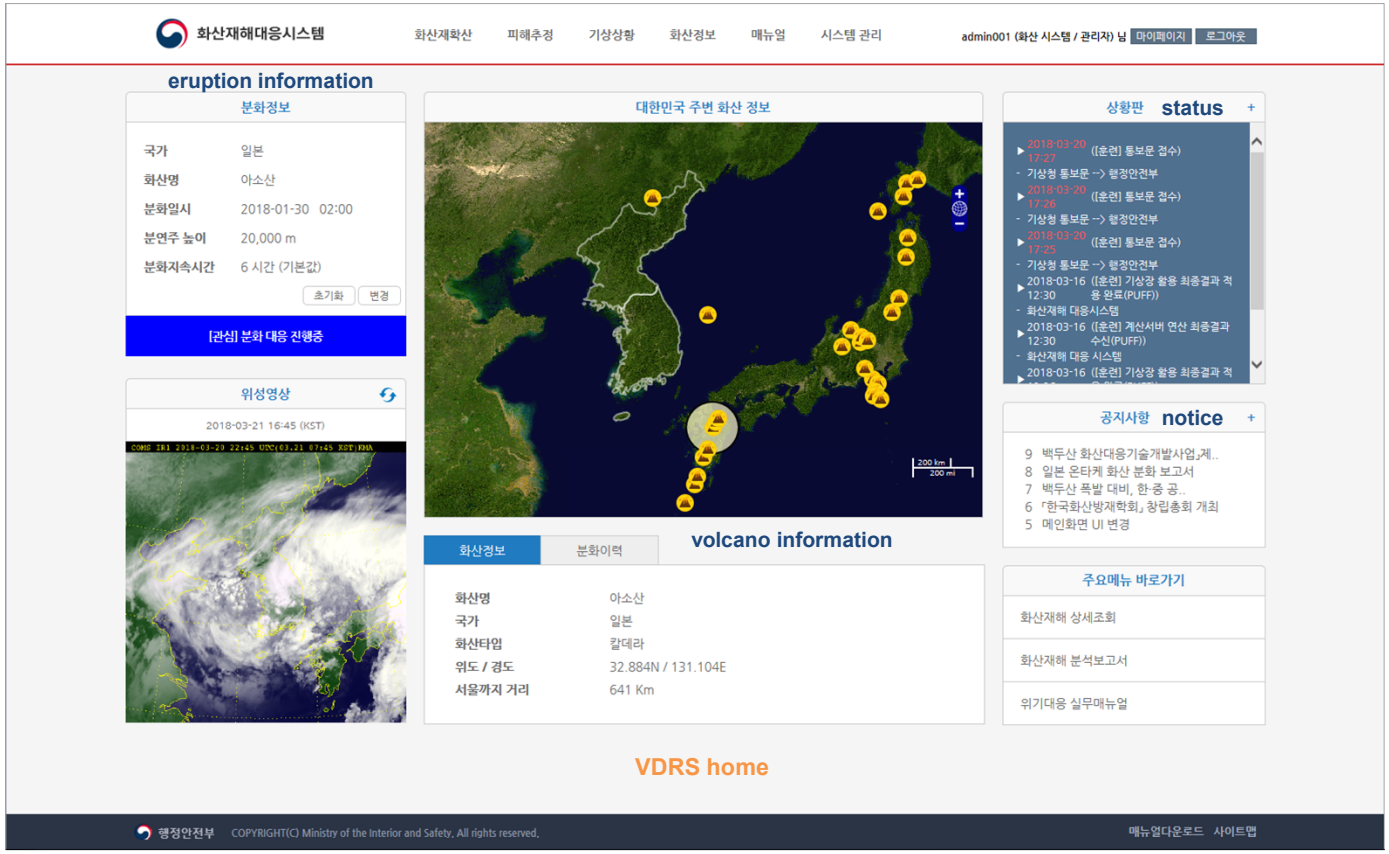
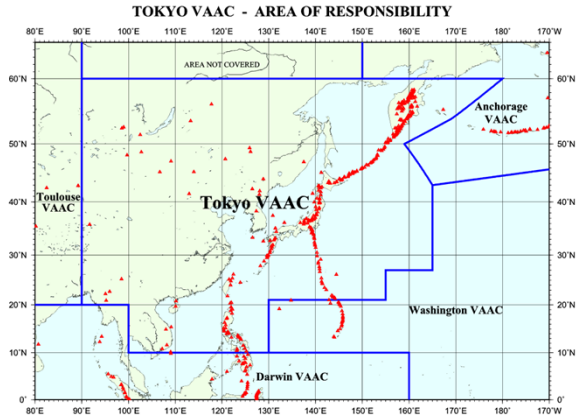


Volcanic Disaster Response System (prototype)



Real-time eruption information from

Tokyo VAAC & KMA

Korea Meteorological Administration

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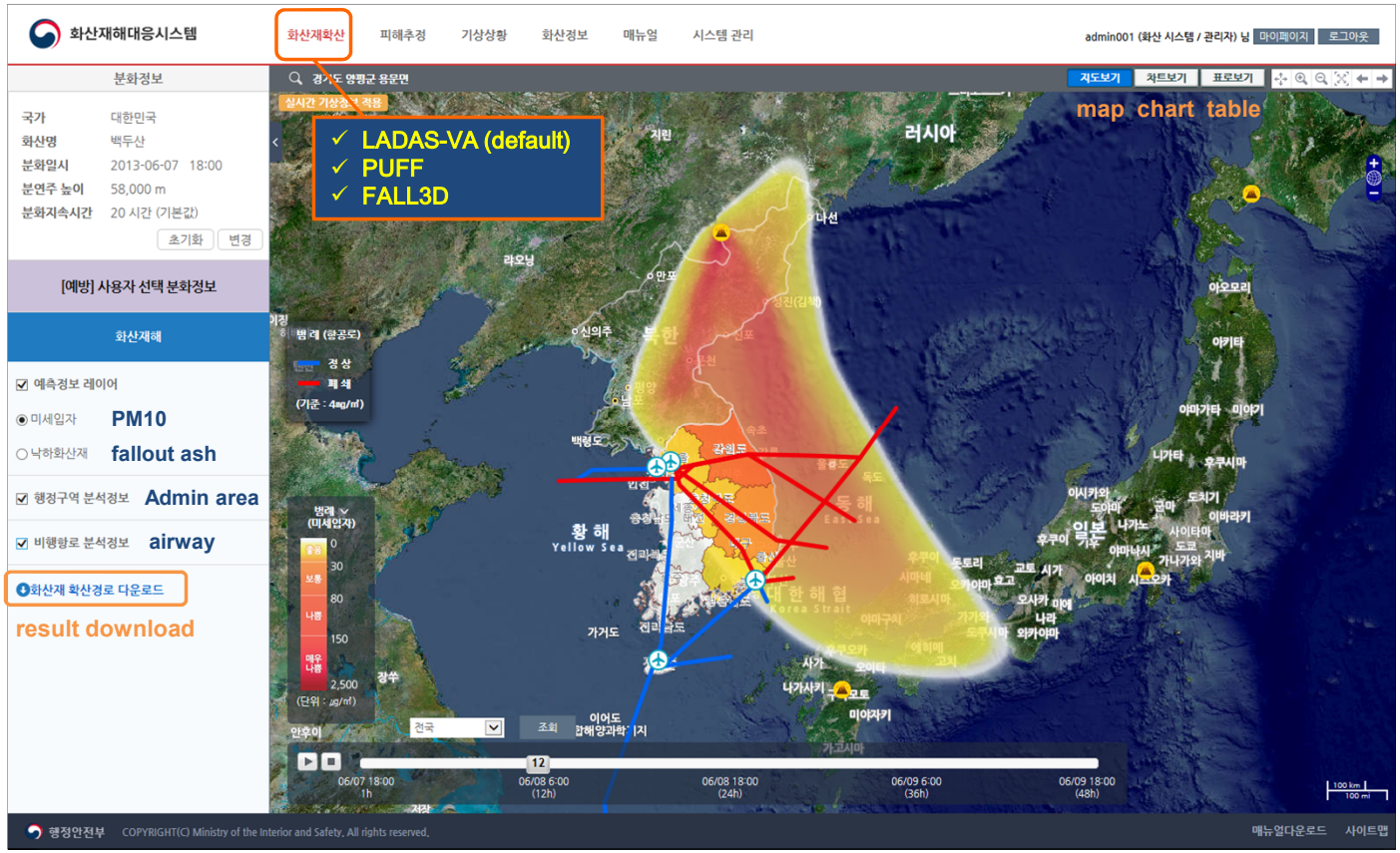
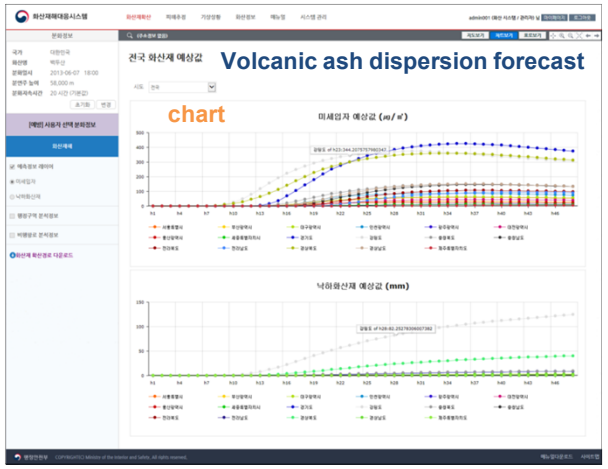
Ash dispersion





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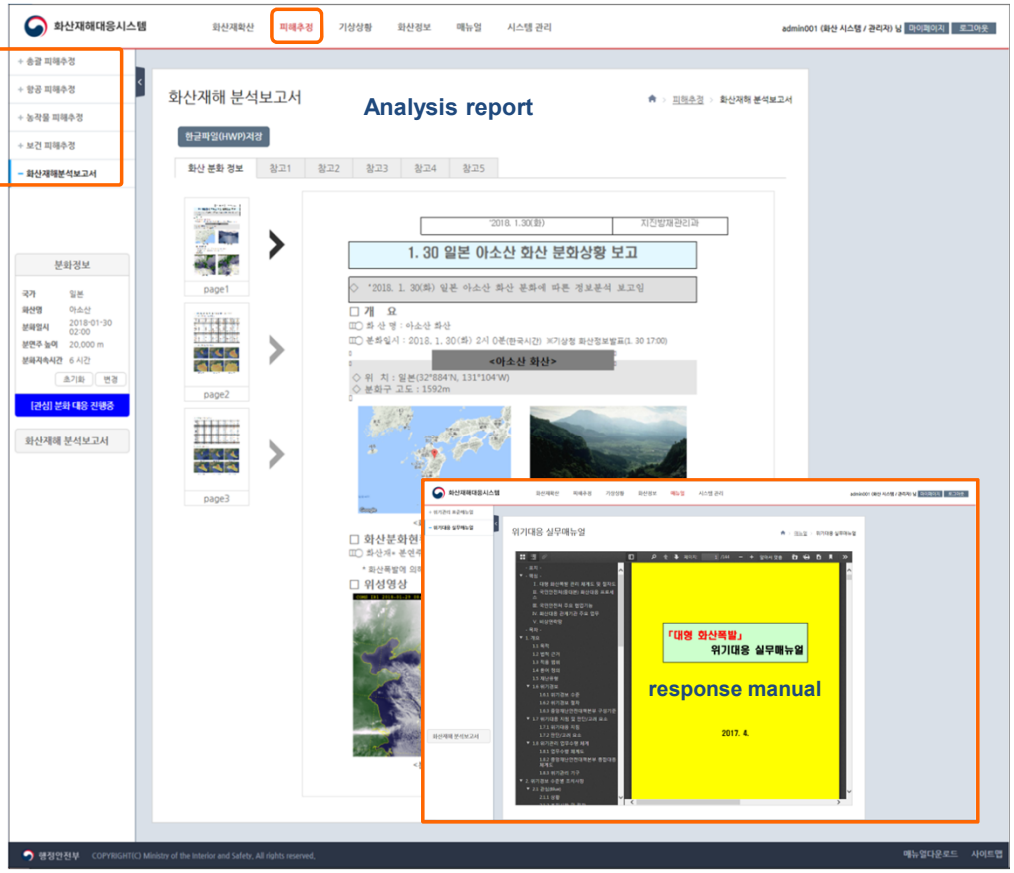
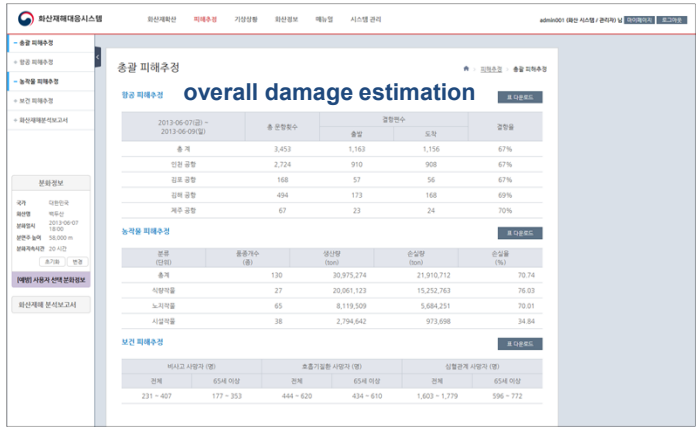
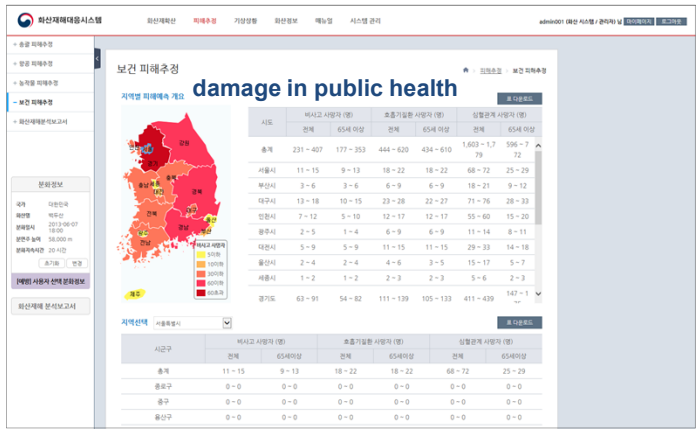
damage prediction

- ✓ overall
- ✓ in airway
- ✓ in agriculture
- ✓ in public health
- ✓ report







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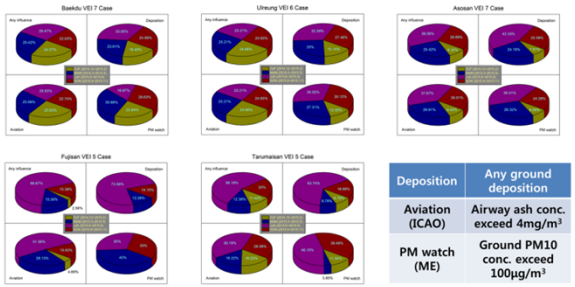
Simulation for Hypothetic Eruptions

By using the LADAS-VA model, we performed a series of simulations for (year-round) hypothetic eruptions of several representative volcanoes around Korea, such as Mt. Baekdu (Changbaishan), Asosan, Ulreung, Fujisan, and Shikotsu (Tarumaisan).

Simulation period	2014.12.1~2016.2.29
Meteorological data	KMA UM-RDAPS (12km-horizontal resolution)
Eruption detail	Start at 00 UTC (each day and lasted 24h)
Calculation period	72h (after eruption started)
VEI (eruption scale)	Historical maximum VEI (for each volcano)
TGSD	Gaussian in Φ

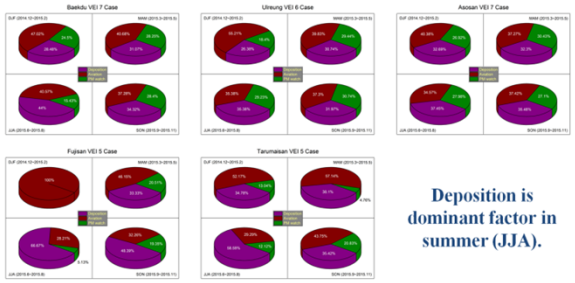
Fig 1. Coverage of the UM-RDAPS meteorological data and 5 representative volcanoes around Korean Peninsula with some simulation information.



Deposition	Any ground deposition
Aviation (ICAO)	Airway ash conc. exceed 4mg/m³
PM watch (ME)	Ground PM10 conc. exceed 100μg/m³

Fig 2. Ratio of influenced days for each season classified into three impact factors (deposition, aviation, and PM watch) with criteria of influence.

Seasonal Influence



Deposition is dominant factor in summer (JJA).

Fig 3. Comparison of seasonal ratio of influenced days due to each impact factor for hypothetic eruptions of representative volcanoes.

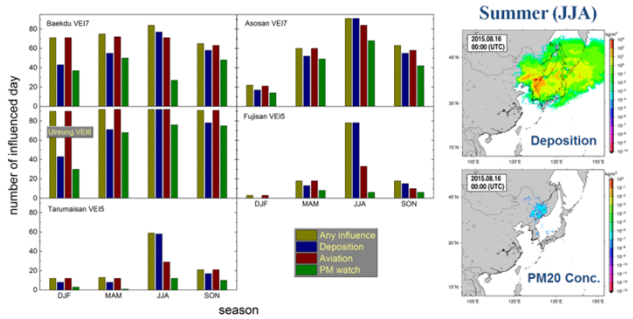


Fig 4. Number of influenced days by hypothetic eruptions of representative volcanoes due to each impact factor for each season (of eruption).

Illustrative Examples

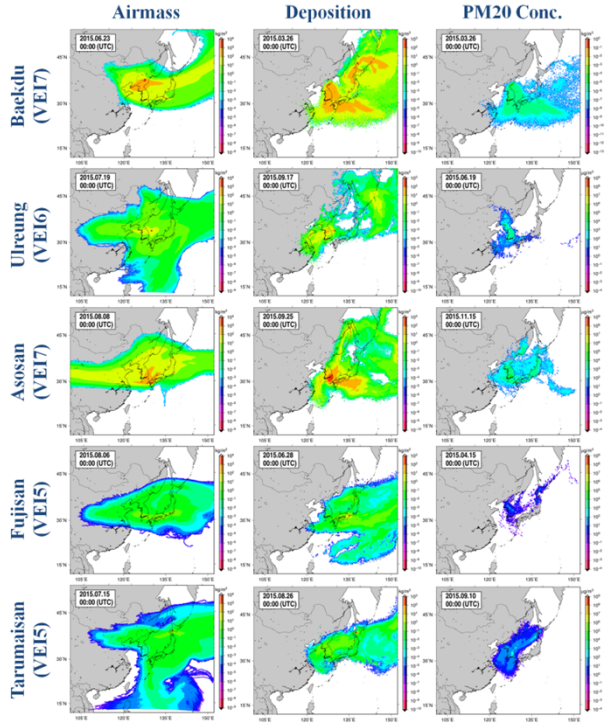


Fig 5. Examples of some hypothetic eruptions which influenced on Korean peninsula.

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Acknowledgement

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